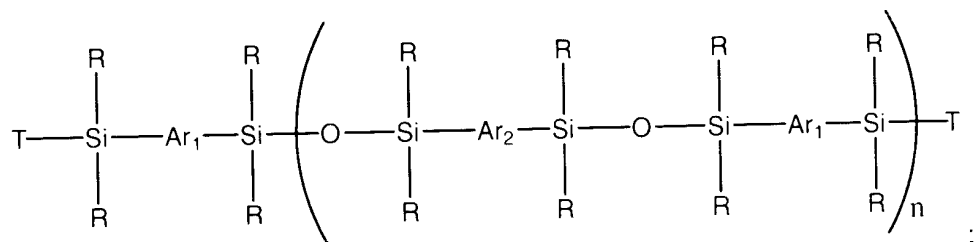CLAIMS

What is claimed is:

1. A prepolymer comprising the formula:
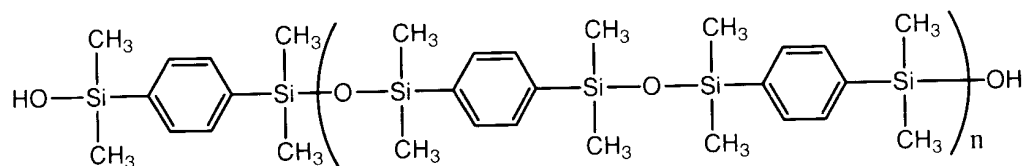

wherein n≥1;

wherein T is either –H or –OH and both T's are the same;
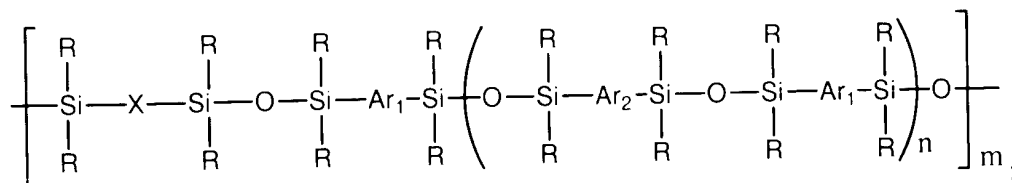
wherein Ar_1 and Ar_2 are independently selected aromatic groups; and

wherein each R is independently selected from the group consisting of

alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and combinations

thereof.

2. The prepolymer of claim 1,

wherein T is –OH.

3. The prepolymer of claim 1,

wherein one or more of the Ar_1 and Ar_2 functional groups is phenylene.

4. The prepolymer of claim 1,

wherein one or more of the R functional groups is –CH_3.

5. The prepolymer of claim 1,

wherein the prepolymer comprises the formula:

6. The prepolymer of claim 5,

wherein n is selected from the group consisting of 1, 2, 3, and 4.

7. A precursor comprising the formula:

$$\left[\begin{array}{c} \overset{\displaystyle R}{\underset{\displaystyle R}{Si}}-X-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}-O-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}-Ar_1-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}\left(O-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}-Ar_2-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}-O-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}-Ar_1-\overset{\displaystyle R}{\underset{\displaystyle R}{Si}}\right)_n O\right]_m$$

wherein $n \geq 0$;

wherein n is an average value obtained by averaging all repeating units of

the precursor;

wherein $m \geq 1$;

wherein X is a divalent group containing one or more acetylenic groups;

wherein Ar_1 and Ar_2 are independently selected aromatic groups; and

wherein each R is independently selected from the group consisting of

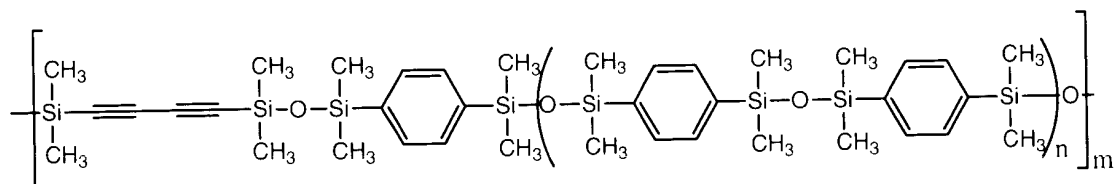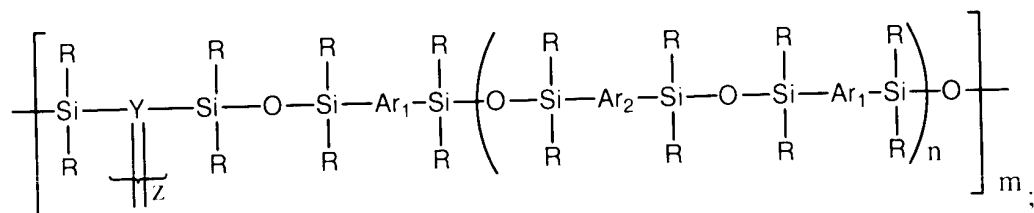alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and combinations

thereof.

8. The precursor of claim 7,

wherein X is 1,4-butadiyne.

9. The precursor of claim 7,

wherein one or more of the Ar_1 and Ar_2 functional groups is phenylene.

10. The precursor of claim 7,

wherein one or more of the R functional groups is $-CH_3$.

11. The precursor of claim 7,

wherein the precursor comprises the formula:

$$\left[\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}-\!\!\equiv\!\!\equiv\!\!-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}-O-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}-\!\!\!\bigcirc\!\!\!-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}\left(O-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}-\!\!\!\bigcirc\!\!\!-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}-O-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}-\!\!\!\bigcirc\!\!\!-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{Si}}\right)_n O\right]_m$$

12. The precursor of claim 11,

wherein n is selected from the group consisting of 1, 2, 3, and 4.

13. A networked polymer comprising the formula:

$$\left[\begin{array}{c} R \\ | \\ -Si-Y-Si-O-Si-Ar_1-Si \\ | \\ R \end{array} \left(\begin{array}{c} R \\ | \\ O-Si-Ar_2-Si-O-Si-Ar_1-Si \\ | \\ R \end{array}\right)_n O- \right]_m;$$

wherein $n \geq 0$;

wherein n is an average value obtained by averaging all repeating units of the networked polymer;

wherein $m \geq 1$;

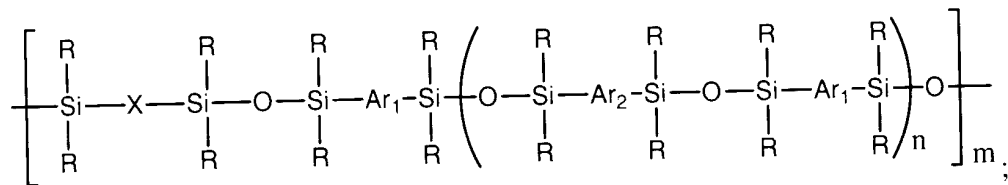wherein Y is a divalent group containing one or more acetylenic groups, one or more ethenyl crosslinks, or both;

wherein z is the crosslink density;

wherein Ar_1 and Ar_2 are independently selected aromatic groups; and

wherein each R is independently selected from the group consisting of alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and combinations thereof.

14. The networked polymer of claim 13,

wherein the networked polymer is formed by crosslinking a precursor comprising the formula:

$$\left[\begin{array}{c} R \\ | \\ -Si-X-Si-O-Si-Ar_1-Si \\ | \\ R \end{array} \left(\begin{array}{c} R \\ | \\ O-Si-Ar_2-Si-O-Si-Ar_1-Si \\ | \\ R \end{array}\right)_n O- \right]_m;$$

wherein X is a divalent group containing one or more acetylenic groups.

15. The networked polymer of claim 14,

wherein X is 1,4-butadiyne.

16. The networked polymer of claim 13,

wherein one or more of the Ar_1 and Ar_2 functional groups is phenylene.

17. The networked polymer of claim 13,

wherein one or more of the R functional groups is $-CH_3$.
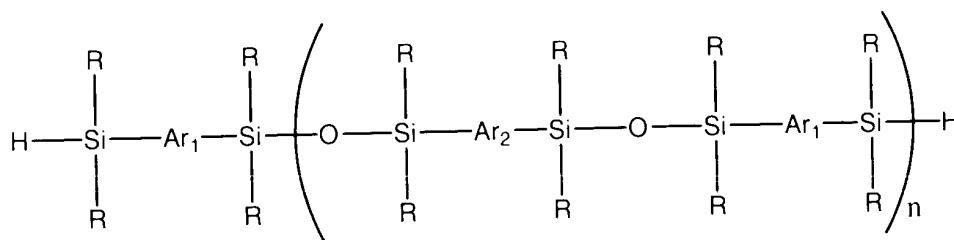
18. The networked polymer of claim 13,

wherein the networked polymer comprises the formula:

19. The networked polymer of claim 18,

wherein the networked polymer is formed by crosslinking a precursor

comprising the formula:

20. The networked polymer of claim 18,

wherein n is selected from the group consisting of 1, 2, 3, and 4.

21. A ceramic composition formed by thermal degradation of the networked polymer

of claim 13.

22. The ceramic composition of claim 21,

wherein the thermal degradation is performed from about 400°C to about

600°C.

23. A process of preparing a prepolymer comprising the formula:

wherein n≥1;

wherein T is either –H or –OH and both T's are the same;

wherein Ar_1 and Ar_2 are independently selected aromatic groups; and

wherein each R is independently selected from the group consisting of

alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and combinations

thereof;

comprising the step of reacting one or more arylenedisilanols with one or more

bissilarylenes;

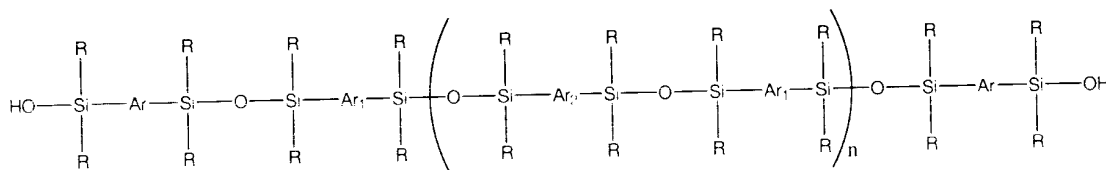wherein either the arylenedisilanol or the bissilarylene is present in an

excess amount.

24. The process of claim 23,

wherein only one arylenedisilanol compound is reacted with only one

bissilarylene compound.

25. The process of claim 23,

wherein the reaction is catalyzed by a rhodium-containing compound.

26. The process of claim 25,

wherein the rhodium-containing compound is $(Ph_3P_3)RhCl$.

27. The process of claim 23,

wherein the reaction is catalyzed by a composition selected from the group

consisting of tris(dibenzylideneacetone)dipalladium-chloroform

adduct, palladium on activated carbon, dicobalt octacarbonyl,

bis(cyclooctadiene)nickel, rhodium-containing compound,

$(Ph_3P_3)RhCl$, and combinations thereof.

28. The process of claim 23,

wherein one or more of the Ar_1 and Ar_2 functional groups is phenylene.

29. The process of claim 23,

wherein one or more of the R functional groups is $-CH_3$.

30. The process of claim 23,

wherein the arylenedisilanol is present in an excess amount to form a

hydroxy-terminated prepolymer comprising the formula:
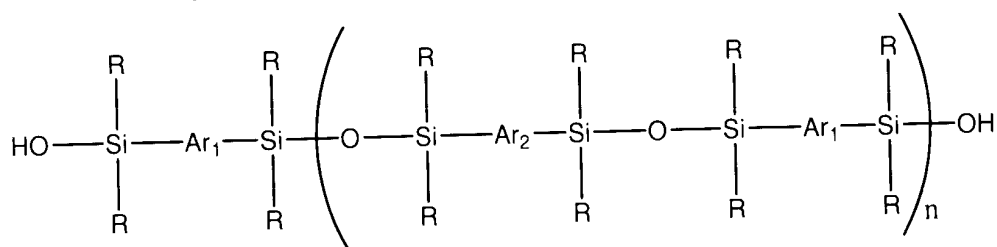
31. The process of claim 23,

wherein the bissilarylene is present in an excess amount, forming a
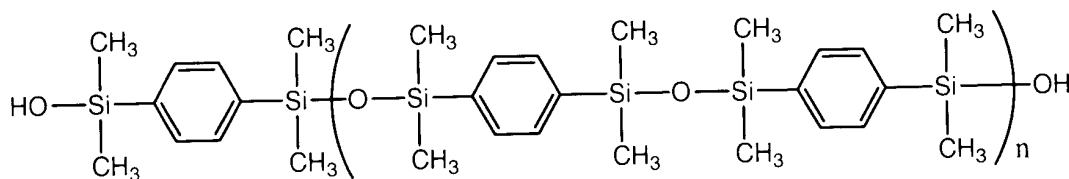
hydride-terminated prepolymer comprising the formula:

$$\text{H}-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Ar_1-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}\left(O-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Ar_2-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-O-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Ar_1-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}\right)_n H$$

32. The process of claim 31,

comprising the additional step of converting the hydride-terminated

prepolymer to a hydroxy-terminated prepolymer.

33. The process of claim 32,

wherein the step of converting the hydride-terminated prepolymer to a

hydroxy-terminated prepolymer comprises reacting the hydride-

terminated prepolymer with one or more arylenedisilanols to form

a hydroxy-terminated prepolymer comprising the formula:

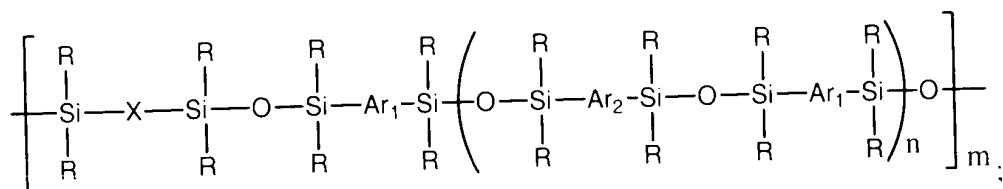$$\text{HO}-Si-Ar-Si-O-Si-Ar_1-Si\left(O-Si-Ar_2-Si-O-Si-Ar_1-Si\right)_n O-Si-Ar-Si-OH$$

wherein each Ar is an independently selected aromatic groups; and

wherein each R is independently selected from the group

consisting of alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and

combinations thereof.

34. The process of claim 23,

wherein the arylenedisilanol is 1,4-bis(hydroxydimethylsilyl)benzene;

wherein the bissilarylene is 1,4-bis(dimethylsilyl)benzene;

wherein the 1,4-bis(hydroxydimethylsilyl)benzene is present in an excess

amount; and

wherein the prepolymer comprises the formula:

$$\text{HO}-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\!\!\langle\!\!\rangle\!\!-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}\left(O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\!\!\langle\!\!\rangle\!\!-\underset{}{\overset{\overset{CH_3}{|}}{Si}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\!\!\langle\!\!\rangle\!\!-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}\right)_n OH$$

35. A process of preparing a precursor comprising the formula:

wherein $n \geq 0$;

wherein n is an average value obtained by averaging all repeating units of

the precursor;

wherein $m \geq 1$;

wherein X is a divalent group containing one or more acetylenic groups;

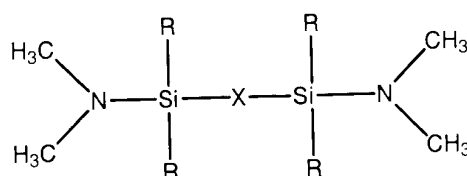wherein Ar_1 and Ar_2 are independently selected aromatic groups; and

wherein each R is independently selected from the group consisting of

alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and combinations

thereof;

comprising the step of:

reacting a prepolymer comprising the formula:
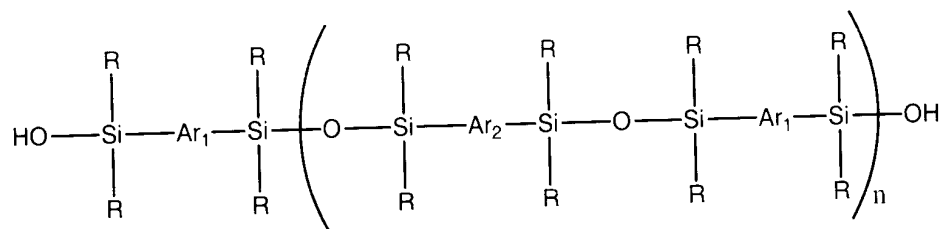
with a bis(dimethylaminosilyl)alkyne comprising the formula:

wherein X is a divalent group containing one or more acetylenic
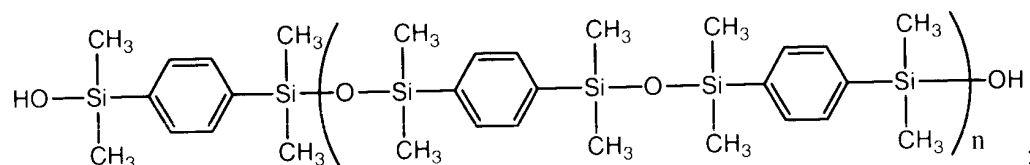
groups.

36.   The process of claim 35,

wherein one or more of the Ar_1 and Ar_2 functional groups is phenylene.

37.   The process of claim 35,

wherein one or more of the R functional groups is $-CH_3$.

38.   The process of claim 35,
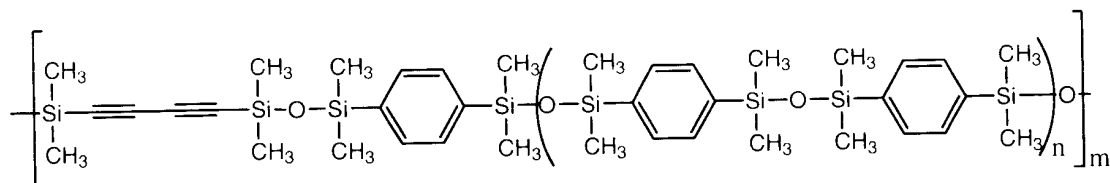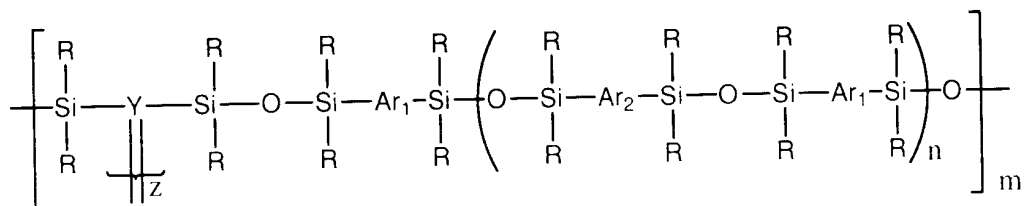
wherein the prepolymer comprises the formula:

$$HO-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\phi-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}\left(O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\phi-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\phi-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}\right)_n OH$$

wherein the bis(dimethylaminosilyl)alkyne is 1,4-

bis(dimethylaminodimethylsilyl)butadiyne; and

wherein the precursor comprises the formula:

$$\left[\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\equiv-\equiv-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\phi-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}\left(O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\phi-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-\phi-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}\right)_n O\right]_m$$

39. A process of preparing a networked polymer comprising the formula:

$$\left[\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Y\!\!\underset{z}{\|}\!\!-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-O-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Ar_1-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}\left(O-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Ar_2-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-O-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-Ar_1-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}\right)_n O\right]_m$$

wherein $n \geq 0$;

wherein n is an average value obtained by averaging all repeating units of

the networked polymer;

wherein $m \geq 1$;

wherein Y is a divalent group containing one or more acetylenic groups,

one or more ethenyl crosslinks, or both;

wherein z is the crosslink density;

wherein Ar_1 and Ar_2 are independently selected aromatic groups; and

wherein each R is independently selected from the group consisting of

alkyl, aryl, alkylaryl, haloalkyl, haloaryl, and combinations
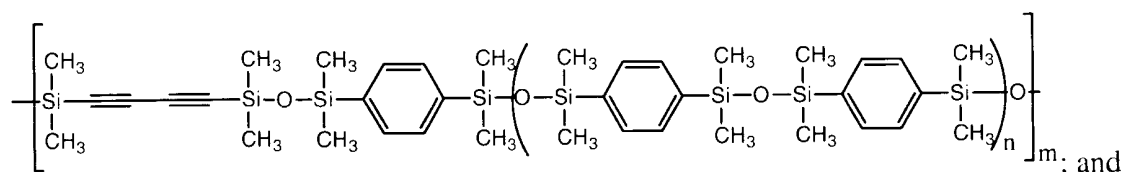
thereof;

comprising the step of:

crosslinking a precursor comprising the formula:

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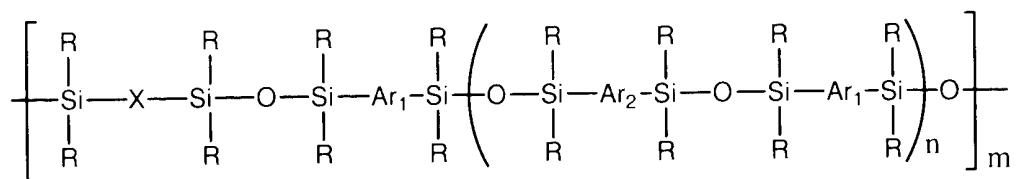
wherein X is a divalent group containing one or more acetylenic

groups.

40. The process of claim 39,

wherein one or more of the Ar_1 and Ar_2 functional groups is phenylene.

41. The process of claim 39,

wherein one or more of the R functional groups is $-CH_3$.

42. The process of claim 39,

wherein the crosslinking is performed by heating the precursor.

43. The process of claim 42,

wherein the heating conditions are at least sufficient to initiate

crosslinking; and

wherein the heating conditions do not cause degradation of the precursor

or the networked polymer.

44. The process of claim 42,

wherein the heating is performed at one or more temperatures from about

100°C to about 500°C.

45. The process of claim 39,

wherein the precursor comprises the formula:

; and

wherein the networked polymer comprises the formula:

.